

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing:

04 November 1999 (04.11.99)

International application No.:

PCT/AU99/00320

Applicant's or agent's file reference:

International filing date:

28 April 1999 (28.04.99)

Priority date:

29 April 1998 (29.04.98)

Applicant:

MORRIS, Geoffrey, R.

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International preliminary Examining Authority on:

28 April 1999 (28.04.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer:

J. Zahra

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PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

REC'D 22 OCT 1999

WIPO PCT

Applicant's or agent's file reference MOR00320.PCT/DAR:kj	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. PCT/AU 99/00320	International filing date (day/month/year) 28 April 1999	Priority Date (day/month/year) 29 April 1998
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁶ E04D 13/18, F24J 2/20, F28F 3/12		
Applicant MORRIS, Geoffrey R.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
- These annexes consist of a total of 14 sheet(s).

3. This report contains indications relating to the following items:

- | | | |
|------|-------------------------------------|---|
| I | <input checked="" type="checkbox"/> | Basis of the report |
| II | <input type="checkbox"/> | Priority |
| III | <input type="checkbox"/> | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| IV | <input checked="" type="checkbox"/> | Lack of unity of invention |
| V | <input checked="" type="checkbox"/> | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| VI | <input checked="" type="checkbox"/> | Certain documents cited |
| VII | <input type="checkbox"/> | Certain defects in the international application |
| VIII | <input checked="" type="checkbox"/> | Certain observations on the international application |

Date of submission of the demand
28 April 1999

Date of completion of the report
12 October 1999

Name and mailing address of the IPEA/AU
AUSTRALIAN PATENT OFFICE
PO BOX 200
WODEN ACT 2606
AUSTRALIA
Facsimile No. (02) 6285 3929

Authorized Officer

VINCE BAGUSAUSKAS

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I. Basis of the report

1. With regard to the **elements** of the international application:*
- ☐ the international application as originally filed.
- ☒ the description, pages 5-7, as originally filed,
pages , filed with the demand,
pages 1-4.1, 8-11, filed with the letter of 15 July 1999.
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages 12-16, filed with the letter of 15 July 1999 .
- ☒ the drawings, pages 1-5, as originally filed,
pages , filed with the demand,
pages , filed with the letter of .
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , filed with the letter of .
2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:
- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, was on the basis of the sequence listing:
- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished
4. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.
5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

The international preliminary examination report has been drawn up in respect of the entire international application but the International Preliminary Examining Authority is of the opinion that the application does not appear to comply with the requirements of unity of invention as set forth in the PCT regulations (Article 34(3), Rule 68(1) PCT).

The separate groups of invention are:

1. Claims 1 to 3, 5 to 7, 9, 10, 12 relate to a solar roofing panel having an internal fluid passage way formed between a pair of spaced internal sheets and respective external passageways formed between each internal sheet and a respective external sheet.
2. Claims 4, 8, 11, 13 to 16 relate to a solar roofing panel having a manifold for a panel as described above, where said manifold includes fluid communication means and gas communication means

These groups are not so linked as to form a single general inventive concept, that is, they do not have any common inventive features, which define a contribution over the prior art. The common concept linking together these groups of claims is a solar roofing panel. However this concept is not novel in the light of US 4114597. Therefore these claims lack unity a posteriori.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report: -

- ☒ all parts.
- ☐ the parts relating to claims Nos.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-16	YES
	Claims	NO
Inventive step (IS)	Claims 1-16	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-16	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

US 4114597 is the closest prior art. This citation does not disclose the invention as defined in the claims.

VI. Certain documents cited**1. Certain published documents (Rule 70.10)**Application No.
Patent No.Publication date
(day/month/year)Filing date
(day/month/year)Priority date (valid claim)
(day/month/year)

L,X AU 68020/98

3 September 1998

21 May 1998

29 April 1998

The above document discloses fully the invention as disclosed in the international application. The citation was published prior to the international filing date.

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure

Date of non-written disclosure
(day/month/year)Date of written disclosure referring to
non-written disclosure
(day/month/year)

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claim 8, appended to claim 3 does not have an antecedent for gas inlet or outlet means.

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"HEAT EXCHANGE ASSEMBLY"REPLACED BY
ART 34 AMDT**Technical field**

5 This invention relates to a heat exchange assembly and to a method of heat exchange.

The invention has particular but not exclusive application to heat exchangers for use in a roof and to solar heat exchangers, although the invention may be utilised in other than roofing systems and in other than solar powered systems.

Background of Invention

Heat exchange assemblies are known in which a roofing panel is comprised of a pair of spaced apart polycarbonate sheets and in which water is heated as it flows between the sheets. International patent application PCT/NO95/00127 in the name of Rekstad illustrates such a system.

Summary of Invention

The present invention aims to provide an alternative to known heat exchange assemblies, known methods of heat exchange and known roofing panels incorporating a heat exchange assembly.

25 This invention in one aspect resides broadly in a heat exchange assembly including:-

an internal fluid passageway formed between a pair of spaced substantially parallel internal sheets for the passage therethrough of a fluid, and

30 respective external passageways formed between each internal sheet and a respective external sheet spaced from and substantially parallel to a respective internal sheet.

In another aspect this invention resides broadly in a method of heat exchange, the method including:-

passing fluid through an internal fluid passageway formed between a pair of spaced substantially parallel internal sheets, the fluid passageway being sandwiched

between respective external passageways formed between each internal sheet and a respective external sheet spaced from and substantially parallel to a respective internal sheet, whereby heat is exchanged between the fluid and gas in the external passageways.

Although the invention is described with reference to the preferred embodiments as having one internal fluid passageway formed between a pair of spaced substantially parallel internal sheets, it is to be understood that there may be a plurality of internal passageways formed between respective pairs of spaced substantially parallel internal sheets. Thus the heat exchange assembly may include more than four sheets.

The sheets can be separated by any suitable spacing means such as posts or the like. However it is preferred that the heat exchange assembly includes:-

spacing ribs between the sheets and forming with the sheets a plurality of fluid conduits within the fluid passageway and a plurality of external conduits within the external passageways.

Preferably the heat exchange assembly includes:-

fluid inlet means at one end of the fluid conduits for the inflow of fluid in the heat exchange assembly, and

fluid outlet means at the other end of the fluid conduits for the outflow of fluid from the heat exchange assembly.

The external passageways can contain another liquid however it is preferred that the external passageways are adapted to receive or contain a gas for effecting heat exchange between the fluid in the fluid passageway and the exterior of the heat exchange assembly, and that the heat exchange assembly includes:-

gas inlet means at one end of the external conduits for the inflow of gas to the heat exchange assembly, and

gas outlet means at the other end of the external conduits for the outflow of gas from the heat exchange assembly.

The gas can be air whereby the external passageways comprise an open system. Alternatively in a closed system the gas can be an inert gas.

5 The heat exchange assembly can be of any suitable shape and configuration consistent with the above. However it is preferred that the heat exchange assembly constitutes a panel sealed at the sides thereof by the spacing ribs and open at the ends thereof to provide access to the conduits which extend from one end of the
10 panel to the other end thereof.

Preferably the panel is suitable for use as roofing.

Accordingly in another aspect this invention resides broadly in a roofing panel incorporating a heat exchange assembly, the roofing panel including:-

15 an internal fluid passageway formed between a pair of spaced substantially parallel internal sheets for the passage therethrough of a fluid;

20 respective external passageways formed between each internal sheet and a respective external sheet spaced from and substantially parallel to a respective internal sheet, and

25 spacing ribs between the sheets and forming with the sheets a plurality of fluid conduits within the fluid passageway and a plurality of external conduits within the external passageways;

wherein the panel is sealed at the sides thereof by the spacing ribs and is open at the ends thereof to provide access to the conduits which extend from one end of the panel to the other end thereof.

30 Fluid and or gas supplies may be connected directly to the respective conduits at the ends of the panel. However it is preferred that the heat exchange assembly includes an inlet manifold and an outlet manifold at respective ends of the panel.

35 Preferably the inlet manifold and the outlet manifold include the fluid inlet means and the fluid outlet means respectively. The inlet manifold and the outlet manifold also preferably include the gas inlet

means and the gas outlet means respectively.

The heat exchange assembly may also include pressure relief means for relieving the pressure in the fluid passageway generated by heating fluid therein. In a preferred embodiment the relief means is a riser positioned in the fluid inlet and/or fluid outlet means.

In another aspect this invention resides broadly in a manifold for connection to a panel as defined above, the manifold including:-

fluid communication means for the inflow or outflow of fluid to or from the fluid conduits, and

gas communication means for the inflow or outflow of gas to or from the external conduits.

The manifold can be connected to the panel in a number of ways. It could for example be a split tube adapted to be retained on ends of the panel by the resilience of the split tube. Alternatively the manifold can be ultrasonically welded to the panel. In a preferred embodiment the manifold includes receiving means for receiving the internal sheets and the external sheets whereby the fluid communication means and the gas communication means are sealingly connected to the fluid passageway and the external passageways respectively.

It is preferred that the manifold is an extrusion and the fluid communication means and the gas communication means are channels in the extrusion.

In a further aspect this invention resides broadly in a heat exchange panel including:-

an internal fluid passageway formed between a pair of spaced substantially parallel internal sheets for the passage therethrough of a fluid;

respective external passageways formed between each the internal sheet and a respective external sheet spaced from and substantially parallel to a respective internal sheet, spacing ribs between the sheets and forming with the sheets a plurality of fluid conduits within the fluid passageway and a plurality of external conduits within the external passageways, and

As is seen in more detail in FIGS 6 and 7, lateral joining strips 28 have a plurality of laterally disposed, outwardly directed and longitudinally extending ribs 29 separated by inwardly directed grooves or slots 30, and a pair of opposed flanges 32 and 33. A plurality of apertures 31 extend along the length of strip 28 for receiving nails 29. In use, the lateral edges of sheets 16, 17, 20 and 21 extending beyond the outermost spacing ribs 18, 22 and 24 are adapted to be closely received in grooves 30 with flanges 32 and 33 being closely received above and below adjoining panels to provide a weatherproof seal along the lateral sides of the panels.

Joining strips 28 can be made from suitable plastic, rubberised material, fibreglass, aluminium or rolled steel. Suitable mastic sealers can also be used to improve weatherproofing.

As is best seen in FIGS 8 and 9, connection of fluid and gas supplies to panels 13 is effected by a manifold 32 attached to the panel ends 54 and 55. Manifold 32 is a longitudinally extending extrusion having fluid communication means in the form of a central channel 33 for the inflow or outflow of fluid to or from fluid conduits 19, and gas communication means in the form of a pair of channels 34 and 35 for the inflow or outflow of gas to or from external conduits 23 and 25 respectively.

Manifold 28 has includes receiving means in the form of a central opening 39 to central channel 36 for receiving internal sheets 16 and 17, and receiving means in the form of slots 36 for receiving external sheets 20 and 21 whereby the fluid communication means 33 and the gas communication means 34 and 35 are sealingly connected to the fluid passageway and the external passageways respectively.

Channels 34 and 35 communicate with the external passageways and external conduits 23 and 25 via longitudinally extending slots 38 in longitudinally extending ribs 37 on either side of central opening 39. Ribs 37 are closely received in external passageways 52

and 53 at the ends 54 and 55 of panel 13.

The fluid or gas supply is connected to manifold 32 by means of a ported cap (not illustrated) which fits closely over one end of the manifold and has connection
5 flanges for connecting gas and/or water lines to the manifold. A blind cap seals the other end of the manifold.

The manifold can be of a standard length corresponding to the width of a heat exchanger panel.
10 Alternatively the manifold can be of variable length which is cut to a required length to suit individual installations with one manifold extending across a number of adjoining panels.

As with joining strips 28, manifolds 32 can be made
15 from suitable plastic, rubberised material, fibreglass, aluminium or rolled steel. Suitable mastic sealers can also be used to improve the seal between the manifold and the ends of the panel.

In use, a method of heat exchange in accordance with
20 the present invention is effected by passing fluid through internal fluid passageway 51 formed between internal sheets 16 and 17, whereby heat is exchanged between the fluid and gas in external passageways 52 and 53 formed between internal sheet 16 and 17 and a
25 respective external sheet 21 and 20.

As can be seen in FIG 9, a riser 60 extends from the uppermost manifold 32 and vents to atmosphere to provide a pressure relief mechanism in the fluid passageway to relieve excess pressures which may be generated during
30 heating of the fluid. Riser 60 comprises a U-tube which communicates with central fluid channel 33 in the manifold. A ball valve or the like (not shown) can be included in the down stream leg of the U-tube.

It will be appreciated that the heat exchange panel
35 of the present invention has a number of advantages of known systems.

The external passageways of the present invention provide a layer between the fluid passageway and the

ambient conditions and depending on the gas therein improves the efficiency of absorption of solar radiation or, in providing an insulating layer can improve the effectiveness of retention of heat generated by solar radiation.

The multiple passageway construction allows the cooling and heating properties of gases such as free air and inert gases to be exploited. The gas carrying external passageways moreover enable the heat exchanger assembly of the present invention to function in conditions where solar radiation is minimal or non-existent.

The venting of the panels ensures that the operating pressure within the fluid circuit is consistent with atmospheric pressure thereby avoiding pressure induced failure of the panel.

It will of course be realised that whilst the above has been given by way of an illustrative example of this invention, all such and other modifications and variations hereto, as would be apparent to persons skilled in the art, are deemed to fall within the broad scope and ambit of this invention as is herein set forth.

claims

1. A heat exchange assembly including:-
an internal fluid passageway formed between a pair
5 of spaced substantially parallel internal sheets for the
passage therethrough of a fluid, and
respective external passageways formed between each
said internal sheet and a respective external sheet
10 spaced from and substantially parallel to a respective
internal sheet.
2. A heat exchange assembly as claimed in claim 1, and
including:-
spacing ribs between said sheets and forming with
15 said sheets a plurality of fluid conduits within said
fluid passageway and a plurality of external conduits
within said external passageways.
3. A heat exchange assembly as claimed in claim 2, and
20 including:-
fluid inlet means at one end of said fluid conduits
for the inflow of fluid in the heat exchange assembly,
and
fluid outlet means at the other end of said fluid
25 conduits for the outflow of fluid from the heat exchange
assembly.
4. A heat exchange assembly as claimed in claim 3,
wherein said external passageways are adapted to receive
30 or contain a gas for effecting heat exchange with the
fluid in said fluid passageway, said heat exchange
assembly including:-
gas inlet means at one end of said external conduits
for the inflow of gas to the heat exchange assembly, and
35 gas outlet means at the other end of said external
conduits for the outflow of gas from the heat exchange
assembly.

5. A heat exchange assembly as claimed in claim 3, said assembly constituting a panel sealed at the sides thereof by said spacing ribs and open at the ends thereof to provide access to said conduits which extend from one end of the panel to the other end thereof.

6. A heat exchange assembly as claimed in claim 5, and including an inlet manifold and an outlet manifold at respective ends of said panel.

7. A heat exchange assembly as claimed in claim 6, wherein said inlet manifold and said outlet manifold include said fluid inlet means and said fluid outlet means respectively.

8. A heat exchange assembly as claimed in claim 7, wherein said inlet manifold and said outlet manifold include said gas inlet means and said gas outlet means respectively.

9. A heat exchange assembly as claimed in claim 3, and including:-

pressure relief means for relieving the pressure in said fluid passageway generated by heating fluid therein.

10. A heat exchange assembly as claimed in claim 9, wherein said pressure relief means is a riser positioned in said fluid inlet and/or fluid outlet means.

11. A method of heat exchange, said method including:-

passing fluid through an internal fluid passageway formed between a pair of spaced substantially parallel internal sheets, said fluid passageway being sandwiched between respective external passageways formed between each said internal sheet and a respective external sheet spaced from and substantially parallel to a respective internal sheet, whereby heat is exchanged between said fluid and gas in said external passageways.

12. A roofing panel incorporating a heat exchange assembly, said roofing panel including:-

an internal fluid passageway formed between a pair of spaced substantially parallel internal sheets for the passage therethrough of a fluid;

respective external passageways formed between each said internal sheet and a respective external sheet spaced from and substantially parallel to a respective internal sheet, and

spacing ribs between said sheets and forming with said sheets a plurality of fluid conduits within said fluid passageway and a plurality of external conduits within said external passageways;

wherein said panel is sealed at the sides thereof by said spacing ribs and is open at the ends thereof to provide access to said conduits which extend from one end of the panel to the other end thereof.

13. A manifold for connection to a panel as claimed in claim 12, said manifold including:-

fluid communication means for the inflow or outflow of fluid to or from the fluid conduits, and

gas communication means for the inflow or outflow of gas to or from the external conduits.

25

14. A manifold as claimed in claim 13, and including:-

receiving means for receiving the internal sheets and the external sheets whereby said fluid communication means and said gas communication means are sealingly connected to the fluid passageway and the external passageways respectively.

15. A manifold as claimed in claim 13, wherein said manifold is an extrusion and said fluid communication means and said gas communication means are channels in said extrusion.

16. A heat exchange panel including:-

an internal fluid passageway formed between a pair of spaced substantially parallel internal sheets for the passage therethrough of a fluid;


5 respective external passageways formed between each said internal sheet and a respective external sheet spaced from and substantially parallel to a respective internal sheet, spacing ribs between said sheets and forming with said sheets a plurality
10 of fluid conduits within said fluid passageway and a plurality of external conduits within said external passageways, and

manifold means including fluid communication means for the inflow or outflow of fluid to or from
15 the fluid conduits, and gas communication means for the inflow or outflow of gas to or from the external conduits;

wherein said panel is sealed at the sides thereof by said spacing ribs and is open at the ends thereof
20 to provide access to said conduits which extend from one end of the panel to the other end thereof.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 99/00320

A. CLASSIFICATION OF SUBJECT MATTER												
Int Cl ⁶ : E04D 13/18, F24J 2/20, F28F 3/12												
According to International Patent Classification (IPC) or to both national classification and IPC												
B. FIELDS SEARCHED												
Minimum documentation searched (classification system followed by classification symbols) E04D 13/18, F24J 2/20, 3/02, 2/22, F28F 3/12, 3/14												
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched												
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT & JAPIO: [IPC as above] & [plate: or sheet: or panel:] & [rib: or post: or pillar: or spacer:] & [parallel or spaced or manifold]												
C. DOCUMENTS CONSIDERED TO BE RELEVANT												
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
X	US 4114597 A (ERB) 19 September 1978	1-3, 5-7, 9-12										
A	WO 89/05433 A1 (EIDMANN <i>et al</i>) 15 June 1989											
L,X	AU 68020/98 (696305) B1 (MORRIS) 3 September 1998 Derives priority from the same basic document as the instant International Application, but published before the international filing date.	1-16										
<input type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex												
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention											
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone											
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art											
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family											
"P" document published prior to the international filing date but later than the priority date claimed												
Date of the actual completion of the international search 12 May 1999		Date of mailing of the international search report 25 MAY 1999										
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929		Authorized officer  VINCE BAGUSAUSKAS Telephone No.: (02) 6283 2110										

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU 99/00320

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member				
US 4114597	AU 49459/79	AU 49460/79	DE 2931591	DE 2931592	US 4178914
	US 4212291	US 4271823			
WO 8905433	EP 393107				
					END OF ANNEX